Extracorporeal Versus Intracorporeal Anastomosis for Laparoscopic Right Hemicolectomy

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Dr. Alessio Pigazzi was appointed the chief of Colon and Rectal Surgery at Weill Cornell Medical Center/NewYork-Presbyterian in 2020. His research focuses on minimally invasive techniques to improve recovery after cancer surgery, postoperative chemotherapy and the relationship between diet and colorectal cancer.

About this article: A right hemicolectomy is currently a standard surgical treatment for cancer found in the right colon. During this procedure, parts of the right colon are removed. Anastomosis is the procedure in which the colon and rectum are reattached after the removal. Extracorporeal anastomosis (sometimes referred to as "EA") is performed outside the body. Intracorporeal anastomosis (sometimes referred to as "IA") is performed inside the body.

In this article, Dr. Pigazzi and his co-authors discuss their research comparing EA and IA. Both techniques have similar short-term outcomes. Dr. Pigazzi and his co-authors believe the smaller incision length required by IA should be studied further.

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Minia Hellan, MD, Casandra Anderson, MD, Alessio Pigazzi, MD, PhD

ABSTRACT

Background: During laparoscopic right hemicolectomy, the anastomosis can be created intra- or extracorporeally. This study aimed to determine whether a difference exists in short-term outcomes between these techniques.

Methods: Prospectively collected data of 80 consecutive patients who underwent laparoscopic right hemicolectomies since 2004 were reviewed retrospectively. An intracorporeal anastomosis was performed in 23 patients, an extracorporeal anastomosis in 57.

Results: There were no significant differences in median length of stay (4 days), number of removed lymph nodes, estimated blood loss, operative time (190 minutes intracorporeal vs. 180 minutes) and postoperative ileus (22% intracorporeal vs. 16%). The incision length was significantly shorter in the intracorporeal group (4cm vs. 5cm; $P=0.004$). Complications related to the anastomosis including twisting of the mesentery (n=2), anastomotic volvulus (n=1), or leak (n=1) occurred in 4 patients in the extracorporeal group compared with one minor anastomotic leak in the intracorporeal group. Major complication rates were similar between the 2 groups (4.3% intracorporeal vs. 5.3% extracorporeal).

Conclusion: The type of anastomosis does not influence short-term outcomes after laparoscopic right hemicolectomy. An intracorporeal anastomosis results in shorter incision length and may decrease wound-related complications.

Key Words: Laparoscopic right hemicolectomy, Extracorporeal, Intracorporeal, Bowel anastomosis.

Dayton, Ohio, USA (Dr Hellan).

Minneapolis, Minnesota, USA (Dr Anderson).

Duarte, California, USA (Dr Pigazzi).

Address reprint requests to: Alessio Pigazzi, MD, PhD, Department of General and Oncologic Surgery, City of Hope National Medical Center, 1500 East Duarte Rd, Duarte, CA 91010, USA. Telephone: (626) 471-7100, Fax: (626) 301-8865, E-mail: apigazzi@coh.org

INTRODUCTION

Laparoscopic colon resection is superior to open surgery in regards to postoperative pain, recovery, and hospital stay.[1–4] However, there are no standardized techniques, and data on technique-specific outcomes are lacking.

Various terms are used for laparoscopic colon surgery in the literature, for example, laparoscopic-assisted colectomy (LAC, usually with extracorporeal anastomosis), hand-assisted colectomy (HAC or HALS), and laparoscopic colectomy with intracorporeal anastomosis (LCIA).[4–8] Additionally, there are various techniques for mobilization of the mesentery (medial-to-lateral vs. lateral-to-medial) and ligation of the vasculature (extra- vs. intracorporeally). Laparoscopic-assisted colectomy (LAC) with creation of an extracorporeal ileocolonic anastomosis (EA) for right- or extended right colectomies remains the preferred approach in most centers.[4,5,9–13] However, this technique limits the ability to choose an extraction site, which is usually a small midline incision. In addition, problems with intestinal alignment after extraction are known to occur. A completely intracorporeal anastomosis (IA) may reduce the likelihood or intestinal twists and offers the possibility of using any abdominal location for specimen extraction.

The question of whether there is any advantage or disadvantage between these 2 techniques remains unanswered. The goal of this retrospective study was to evaluate the safety and feasibility of an intracorporeal anastomotic technique for laparoscopic right hemicolectomies. We hypothesize that short-term outcomes between IA and EA are similar.

MATERIALS AND METHODS

Patients

All patients requiring a right hemicolectomy for neoplasm who presented to City of Hope from September 2004 to April 2008 were analyzed. Data such as sex, age, body mass index (BMI), pathology, operative technique, blood loss, operative times, intra- and postoperative complications, and length of stay were entered into a prospective

database approved by the Institutional Review Board. During the study period, 80 laparoscopic right hemicolectomies with either an intracorporeal (IA, n=23) or extracorporeal (EA, n=57) anastomosis were performed. A retrospective analysis of all data collected in regards to these 80 laparoscopic right hemicolectomies was performed. To ensure accuracy of the collected data, medical records of all cases including operative reports were reviewed. The 3 right hemicolectomies that were converted from a laparoscopic to an open approach were not included, as conversion rate was not an outcome parameter in this study. Due to the retrospective nature of this study, an intention to treat analysis could not be performed. The type of anastomosis was the surgeon's preference. All cases with IA were performed by a single surgeon (A. Pigazzi) starting in January 2006 with all his cases performed with an IA by June 2006. All patients had preoperative colonoscopies with biopsy and tattooing of lesions located in areas other than the cecum. Postoperative ileus was defined as abdominal distension requiring either conversion to an NPO-status after a diet was started, placement of a nasogastric tube for decompression, or radiological imaging.

Surgical Technique

Pneumoperitoneum was created either via the percutaneous insertion of a Veress needle or with the open Hassan technique as per surgeon's preference. Four to 5 ports were used: a 10-mm to 12-mm umbilical camera port for a 30-degree laparoscope, one 10-mm working port for stapling devices in the left lower abdomen, and 2 to 3 five-mm working ports located in the left upper abdomen and suprapubic region. The mobilization of the right colon and mesentery was carried out in a medial-to-lateral fashion in most cases as previously described.[14]

In the EA group, the ileocolic pedicle and the right branch of the middle colic artery were divided close to their origin intracorporeally with a vascular Endo-GIA stapler or hemoclips in 26 patients. In 15 cases, the ileocolic pedicle was divided intracorporeally, whereas branches of the middle colic artery and the remaining mesentery were ligated after the colon was exteriorized. In the remaining 16 cases, a completely external division of the mesentery and ileocolic pedicle was performed. The exteriorization of the colon and creation of the external anastomosis was carried out in most cases through extension of the umbilical port to a 4-cm to 8cm midline incision after sufficient mobilization of the right colon and hepatic flexure. A side-to-side, stapled ileocolonic anastomosis was created in all cases with a stapled closure of the enterotomy in

91% of cases and a double-layer, hand-sewn closure in the remaining 9%. The anastomosis was re-evaluated in situ after closure of the incision and reinsertion of the laparoscope in all cases.

In the IA group, the ileocolic pedicle and middle colic branches were divided with an Endo-GIA stapler, vascular load. After completion of the medial-to-lateral mobilization, the terminal ileum and transverse colon were divided intracorporeally with a 60-mm Endo-GIA stapler, blue load. In 21 patients, we used a Pfannenstiel incision covered with a wound protector to retrieve the specimen. The specimen was always opened on the side table to ensure that the tumor or inked lesion was included in the resection. After closure of the incision and re-insufflation of the pneumoperitoneum, the intracorporeal ileocolonic anastomosis was created in a side-to-side, isoperistaltic fashion by using the 60-mm Endo-GIA. The enterotomy was then closed laparoscopically with a 2-layer, running suture with 3.0 Vicryl.

Wound protectors were used in all 80 cases; bags for specimen extraction were not used in the IA group.

Statistical Analysis

This was a retrospective analysis of prospectively collected data. Quantitative and categorical variables were analyzed with a 2-tailed, unpaired Student t test and the chi-square or Fisher exact probability test, respectively. $P \leq 0.05$ was considered significant.

Table 1.
Patient Demographic Data

	IA* n = 23	EA* n = 57
Age (years)[a]	69 (45–80)	67 (38–94)
Sex	7F: 16M	28F: 29M
BMI kg/m²†	27 (20–41)	28 (19–39)
ASA score†	3 (2–4)	2 (2–4)
Operation		
Extended Right	1	9
Right	22	48
Pathology	2 lymphoma	2 carcinoid
	6 benign	19 benign
	15 cancer	36 cancer

*IA: intracorporeal anastomosis; EA: extracorporeal anastomosis; ASA: American Society of Anesthesiology Score.

†Median values.

Table 2.
Operative Data

	IA* n = 23	EA* n = 57	P Value
Division of mesentery			
Intracorporeal	23	26	
Extracorporeal	NA	16	
Intra/extra combined	NA	15	
Operative time (min)†	190 (100–340)	180 (60–320)	NS
EBL (mL)†	50 (20–300)	100 (25–700)	0.09
Incision length (cm)†	4 (3–5)	5 (4–8)	0.004
Number of nodes removed†	18 (8–35)	17 (3–40)	NS
Length of stay (days)†	4 (2–14)	4 (2–17)	NS

*IA = intracorporeal anastomosis; EA = extracorporeal anastomosis.
†Median values.

RESULTS

Between September 2004 and May 2008, eighty patients underwent successful laparoscopic right hemicolectomies. Demographic and pathologic data for the study cohort are listed in **Table 1**. In 57 patients, an extracorporeal anastomosis was performed, while 23 patients had an intracorporeal anastomosis. Short-term outcomes including operative and postoperative details are shown in **Table 2**. There was no statistically significant difference in operative time, estimated blood loss, number of nodes harvested, or length of hospital stay between the 2 groups. The length of the incision was significantly shorter in the IA group (4cm vs. 5cm, P=0.004). Overall, 17.5% (14/80) of patients had postoperative ileus **(Table 3)**. However, there was no difference in the incidence of ileus between the 2 groups (22% IA vs. 16% EA, P=0.75).

In the EA group, 3 (5.3%) patients had intraoperative complications that included 2 cases of twisted mesentery requiring intraoperative revision of the anastomosis, and one case of bleeding from the extracorporeally divided mesentery. This was successfully controlled after the incision was elongated by 4cm. One volvulus of the anastomosis caused a complete bowel obstruction requiring reoperation on postoperative day #8. One patient in the EA group experienced an anastomotic leak, which was treated with an end-ileostomy. Overall, 4 (7%) complications were directly related to the anastomosis in the EA group compared with one (4.3%) in the IA group (P=1.0). The one anastomotic-related complication in the IA group included a leak from the anastomosis in a patient with a

Table 3.
Complications

	IA* n = 23	EA* n = 57	P Value*
Gastrointestinal			
Intraoperative (%)	0	3 (5.3)	NS
Ileus (%)	5 (22)	9 (16)	NS
Anastomotic leak (%)	1 (4.3)	1 (1.6)	NS
Volvulus (%)	0	1 (1.6)	NS
Death (%)	0	1 (1.6)	NS
Others			
Pneumonia (%)	1 (4.3)	0	NS
Wound infection (%)	5 (21.7)	3 (5.3)	NS
Incisional hernia (%)	2 (8.7)	4 (7)	NS
Internal hernia (%)	0	1 (1.6)	NS
Postoperative transfusion	1 (4.3)	1 (1.6)	NS
Major morbidity (%)	1 (4.3)	3 (5.3)	NS

*IA = intracorporeal anastomosis; EA = extracorporeal anastomosis; NS=not significant.

BMI (body mass index) of 37kg/m². The leak was successfully managed with percutaneous drainage. Overall, the major complication rate for all patients (2 anastomotic leaks, 1 reoperation for volvulus, and 1 death) was 6.25% (5/80) with no statistically significant difference between groups **(Table 3)**.

The only death in our series occurred in a patient from the EA group (overall 30-day mortality 1.3%). This patient was

initially discharged on postoperative day #7, but readmitted on postoperative day #12 for acute abdomen. A significant amount of ischemic small bowel proximal to the anastomosis due to vascular compromise was found, and the patient developed multisystem organ failure. Injury to the SMA/SMV during the dissection or forceful stretching of the mesentery may have caused this fatal bowel ischemia; however, we cannot conclude whether this was related to the anastomotic technique.

One patient in the IA group was converted from an extracorporeal approach due to a short mesentery and a high BMI of 32 kg/m^2, but was counted in the IA group.

Late complications consisted of 4 (7%) incisional hernias in the EA group, 2 (8.7%) in the IA group, and 1 internal hernia requiring reoperation 6 months after surgery in the EA group. The 2 incisional hernias in the IA group occurred in the only 2 patients in whom the specimen was not removed through a Pfannenstiel incision.

DISCUSSION

The literature is limited comparing outcomes between the different surgical techniques in laparoscopic colon resections. Bernstein at al[15] compared laparoscopic-assisted versus completely laparoscopic colectomies and found no difference in the length of hospital stay or the duration of postoperative ileus. However, no right hemicolectomies were included in the completely laparoscopic group. Only 4 studies describe their experience with intracorporeal ileocolonic anastomosis.[7,8,16,17] The series by Franklin et al[8] is the largest series comparing intracorporeal anastomosis for right colon resections (n=82) with 10 cases with extracorporeal anastomosis. Their intracorporeal approach was found to be safe and feasible with similar operative times and complication rates. These findings are confirmed by Bergamaschi et al[17] who recently described the short-term outcomes of 111 intracorporeal right colectomies.

However, the most commonly applied technique for creation of an anastomosis after laparoscopic right colectomy remains an extracorporeal, stapled ileocolonic anastomosis. In this laparoscopic-assisted technique, the mesentery and ileocolic vessels can be either divided intra- or extracorporeally. Some authors[18] argue that, once mobilized, the right colon is a midline structure and can be easily exteriorized through a 4-cm to 6-cm midline incision that directly overlies the base of the ileocolic pedicle, allowing

for easy proximal ligation. The limitations of this approach include poor exposure of the ileocolic pedicle in obese patients through a small incision as well as limitations in regards to the location of the incision. Difficult exposure of the base of the mesentery could lead to compromise of a high mesenteric ligation necessary for optimal oncologic outcome. Therefore, many series describe the technique of intracorporeal high-vessel ligation combined with an extracorporeal anastomosis.[4,5,9–13] We did not see a difference in the number of lymph nodes in either group; however, our numbers may be too low to detect any significant difference.

The creation of the anastomosis in an obese patient may be facilitated by an internal approach, because this technique eliminates the need to exteriorize heavy mesentery and large specimens through a small incision in a thick abdominal wall. Raftopoulos et al[16] compared laparoscopic right hemicolectomies with intracorporeal anastomosis in the obese and nonobese patients and reported the same incision length, conversion rate, morbidity, and length of stay for thin and obese patients. This compares very favorably with other reports in the literature with conversion rates up to 39% and morbidity rates up to 52% for laparoscopic-assisted colectomies with extracorporeal anastomosis in obese patients.[19,20] In our series, one patient with a BMI of 32 kg/m^2 scheduled for an EA was found to have shortened, thick small bowel mesentery so that the terminal ileum could not be exteriorized adequately. He was therefore converted to an IA, thus avoiding conversion to an open procedure. This may suggest an advantage of the intracorporeal anastomosis in patients with short or very heavy mesentery.

An additional benefit of the intracorporeal technique is the ability to remove the specimen through any type of incision. Incisional hernia rate in laparoscopic colon surgery is described as high as 17% to 24% with a higher rate for midline versus off-midline incisions.[21,22] In comparison, the Pfannenstiel incision is known for excellent cosmetic results and rare incisional hernia rates of 0% to 2%.[23] Interestingly, the 2 incisional hernias in the IA group occurred in the only 2 patients in which the specimen was removed though a small midline incision. Overall, 6 hernias occurred in 59 patients with midline incisions, which equals a hernia rate of 10.2% with the midline incision compared with 0% (0/21) with the Pfannenstiel incision. Therefore, our practice has been modified to only perform Pfannenstiel incisions for specimen extraction after intracorporeal anastomosis.

In the EA group, all major complications were related to gastrointestinal problems. It appears that alignment of the mesentery or volvulus of the anastomosis itself can be a problem when an extracorporeal anastomosis is performed. In 2 patients in the EA group, the anastomosis had to be redone due to twisting of the mesentery, and in one patient a volvulus of the anastomosis was missed leading to reoperation for bowel obstruction. These problems were not encountered in the IA group. References in the literature in regards to this problem are scarce. Senagore et al[12] reported a 1.6% incidence of operative small bowel obstruction in their series of 70 laparoscopic-assisted right hemicolectomies.

Some opponents of laparoscopic colectomy with IA argue that the operative time is longer, especially because the IA approach requires laparoscopic suturing skills. In our series, the median operative time of 190 minutes for the IA group was not significantly different from the operative time of 180 minutes for the EA group. The 4 studies on intracorporeal anastomosis with right colectomies[7,8,16,17] reported operative times from 120 minutes to 218 minutes comparing favorably to operative times of 85 minutes to 190 minutes recorded for laparoscopic-assisted colectomies with extracorporeal anastomosis.[4,5,9–12]

CONCLUSION

These early results show that an intracorporeal anastomosis with transabdominal extraction has similar outcomes compared with extracorporeal anastomosis for laparoscopic right colectomies. However, there appears to be a trend towards smaller incision length in the IA group compared with a trend of more anastomosis-related complications in the EA group. Because our study is a retrospective analysis of a small number of cases, a larger prospective trial will be necessary to confirm these findings.

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